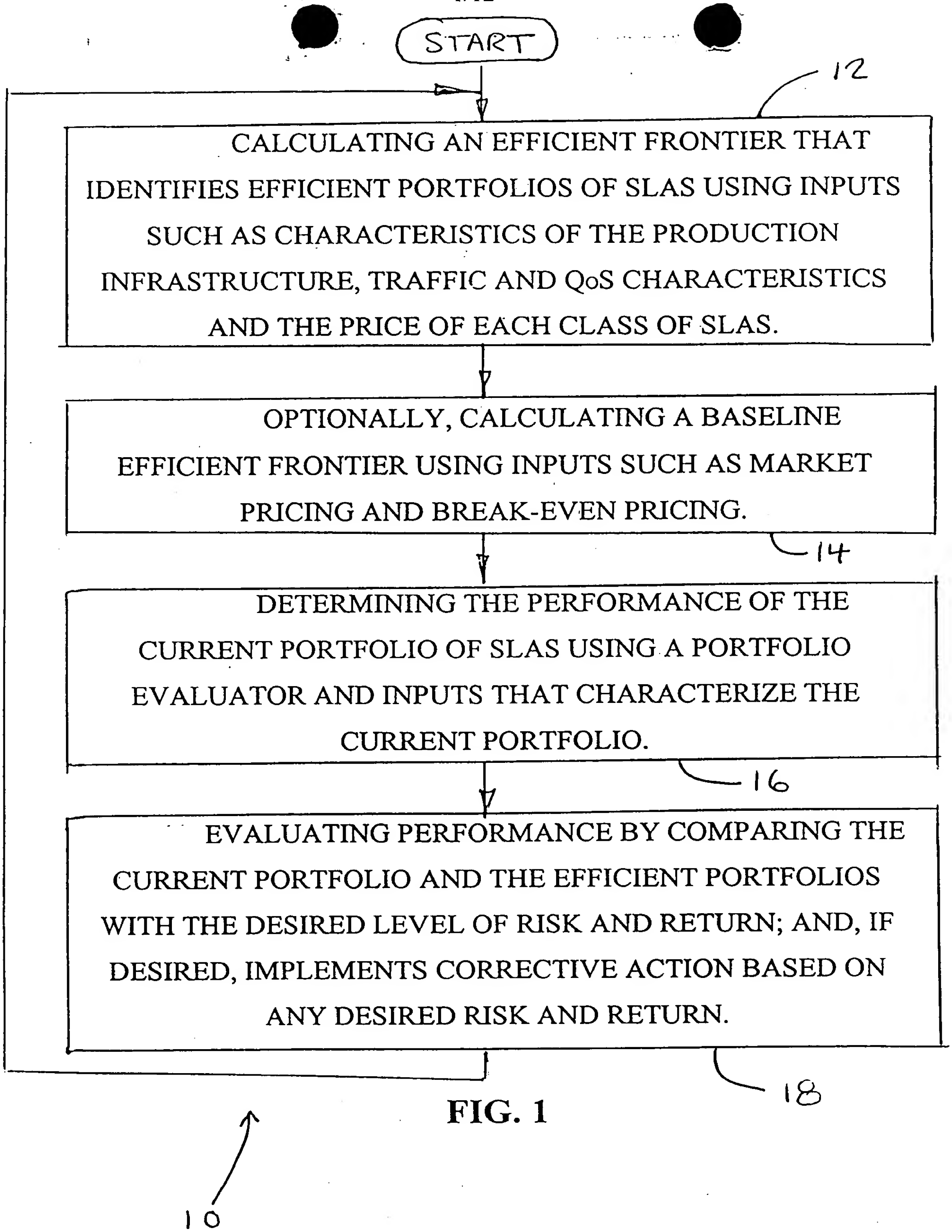
START
12
CALCULATING AN EFFICIENT FRONTIER THAT IDENTIFIES EFFICIENT PORTFOLIOS OF SLAS USING INPUTS SUCH AS CHARACTERISTICS OF THE PRODUCTION INFRASTRUCTURE, TRAFFIC AND QoS CHARACTERISTICS AND THE PRICE OF EACH CLASS OF SLAS.
OPTIONALLY, CALCULATING A BASELINE EFFICIENT FRONTIER USING INPUTS SUCH AS MARKET PRICING AND BREAK-EVEN PRICING.
14
DETERMINING THE PERFORMANCE OF THE CURRENT PORTFOLIO OF SLAS USING A PORTFOLIO EVALUATOR AND INPUTS THAT CHARACTERIZE THE CURRENT PORTFOLIO.
16
EVALUATING PERFORMANCE BY COMPARING THE CURRENT PORTFOLIO AND THE EFFICIENT PORTFOLIOS WITH THE DESIRED LEVEL OF RISK AND RETURN; AND, IF DESIRED, IMPLEMENTS CORRECTIVE ACTION BASED ON ANY DESIRED RISK AND RETURN.
18
10

FIG. 1

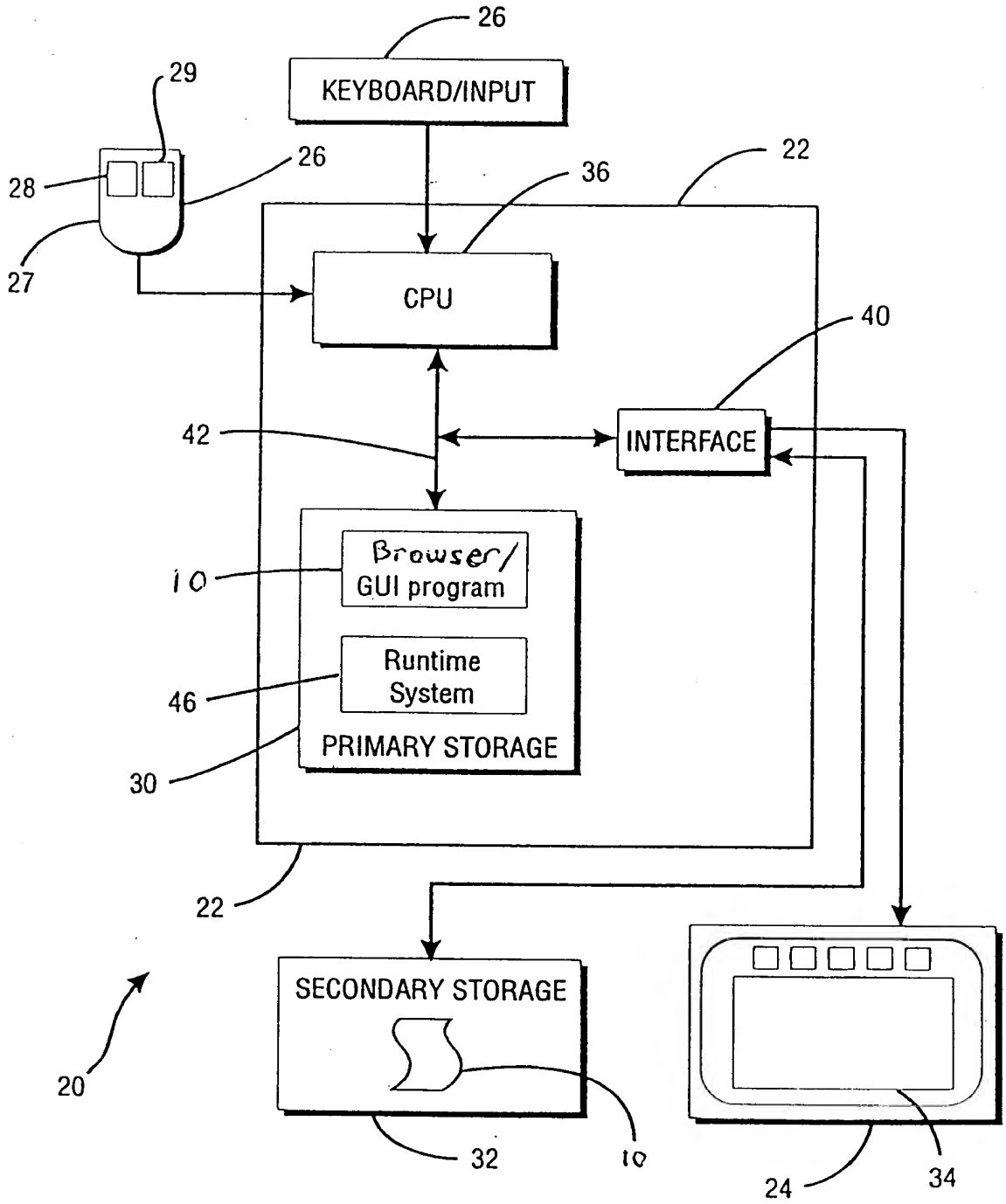
26
KEYBOARD/INPUT
29
28
26
27
22
36
CPU
40
42
INTERFACE
10
Browser/
GUI program
46
Runtime
System
PRIMARY STORAGE
30
22
20
SECONDARY STORAGE
32
10
24
34

FIG. 2

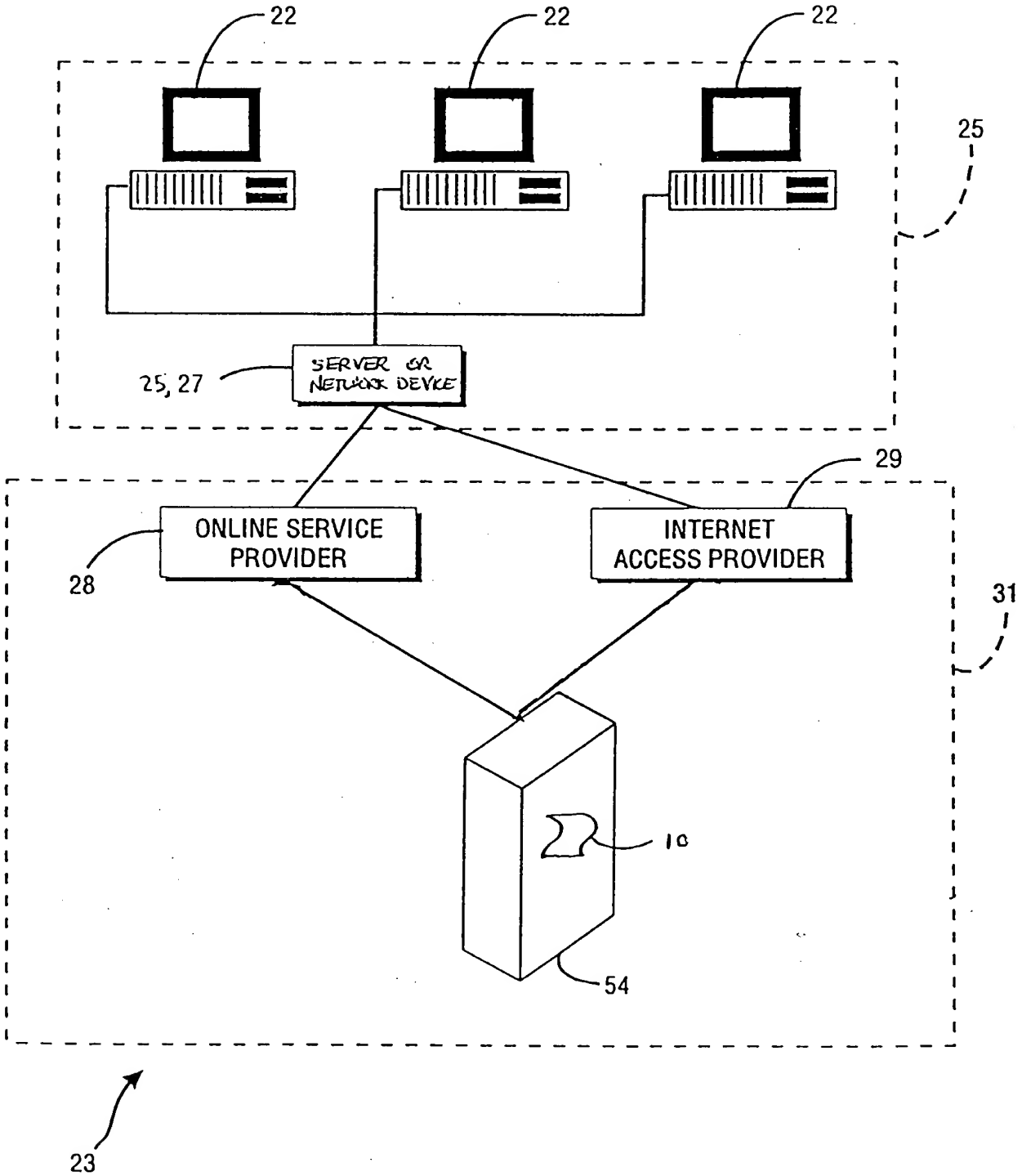
22
22
22
25
25, 27
SERVER OR NETWORK DEVICE
29
ONLINE SERVICE PROVIDER
28
INTERNET ACCESS PROVIDER
31
10
54
23

FIG. 3

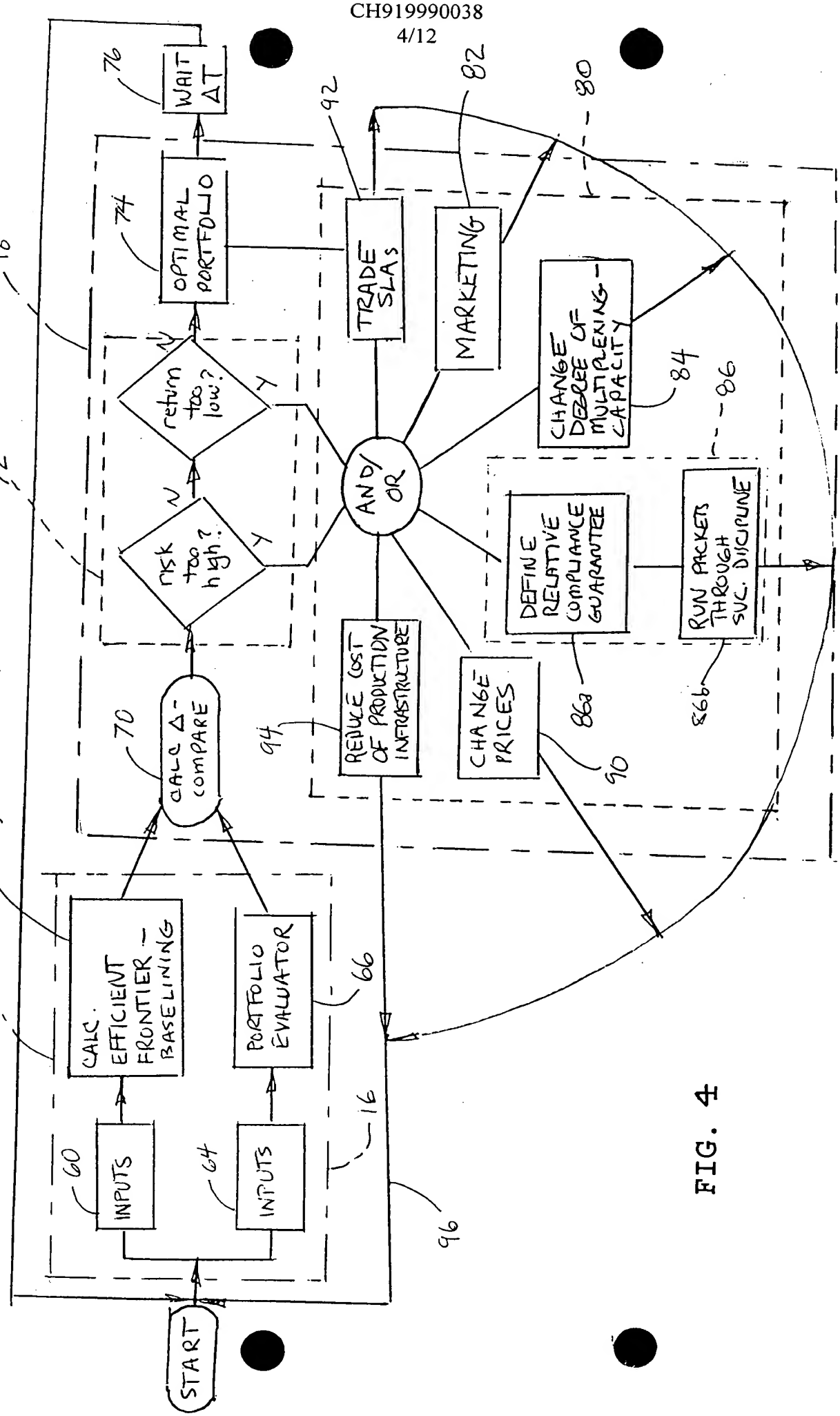
START
INPUTS
60
INPUTS
64
CALC. EFFICIENT FRONTIER - BASELINING
PORTFOLIO EVALUATOR
66
CALC Δ - COMPARE
70
WAIT ΔT
76
OPTIMAL PORTFOLIO
74
RISK too high?
N
Y
RETURN too low?
N
Y
AND/OR
TRADE SLA's
92
MARKETING
82
80
CHANGE DEGREE OF MULTIPLEXING - CAPACITY
84
86
DEFINE RELATIVE COMPLIANCE GUARANTEE
RUN PACKETS THROUGH SVC. DISCIPLINE
REDUCE COST OF PRODUCTION INFRASTRUCTURE
94
CHANGE PRICES
90
86a
86b
12
14, 62
16
18
72
96

FIG. 4

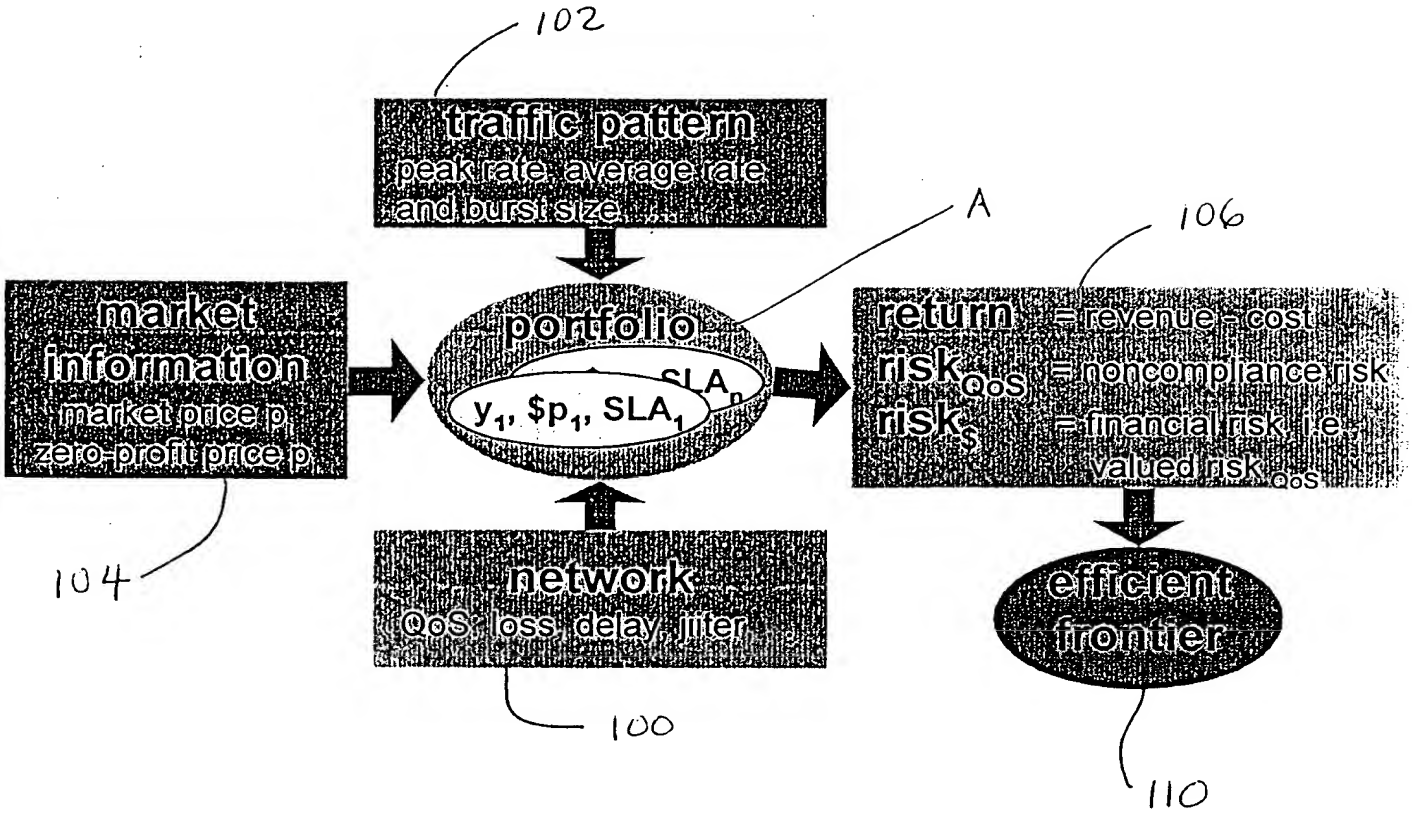
102
traffic pattern
peak rate, average rate
and burst size
A
106
market
information
market price p
zero-profit price p
portfolio
SLA_n
y_1, $\$p_1$, SLA_1
return = revenue - cost
$risk_{QoS}$ = noncompliance risk
$risk_{\$}$ = financial risk i.e.,
valued $risk_{QoS}$
104
network
QoS: loss, delay, jitter
efficient
frontier
100
110

FIG. 5

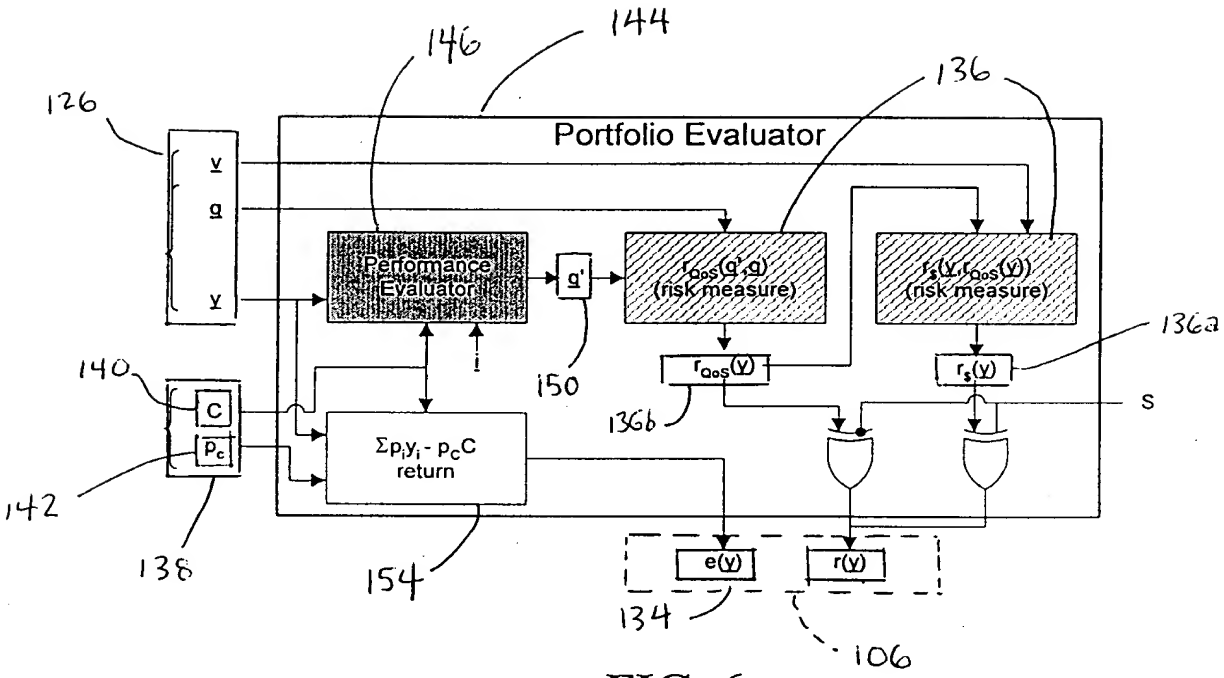
146
144
136
126
Portfolio Evaluator
v
q
y
Performance Evaluator
q'
$r_{QoS}(q',q)$ (risk measure)
$r_s(y, r_{QoS}(y))$ (risk measure)
136a
140
C
p_c
150
$r_{QoS}(y)$
$r_s(y)$
136b
s
$\Sigma p_i y_i - p_c C$ return
142
138
154
e(y)
r(y)
134
106

FIG. 6

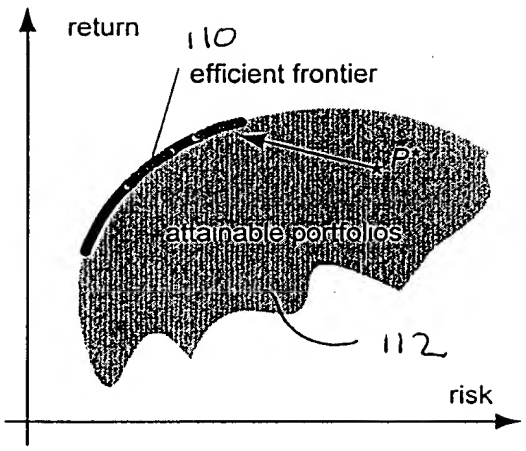
return
110
efficient frontier
P
attainable portfolios
112
risk

FIG. 7

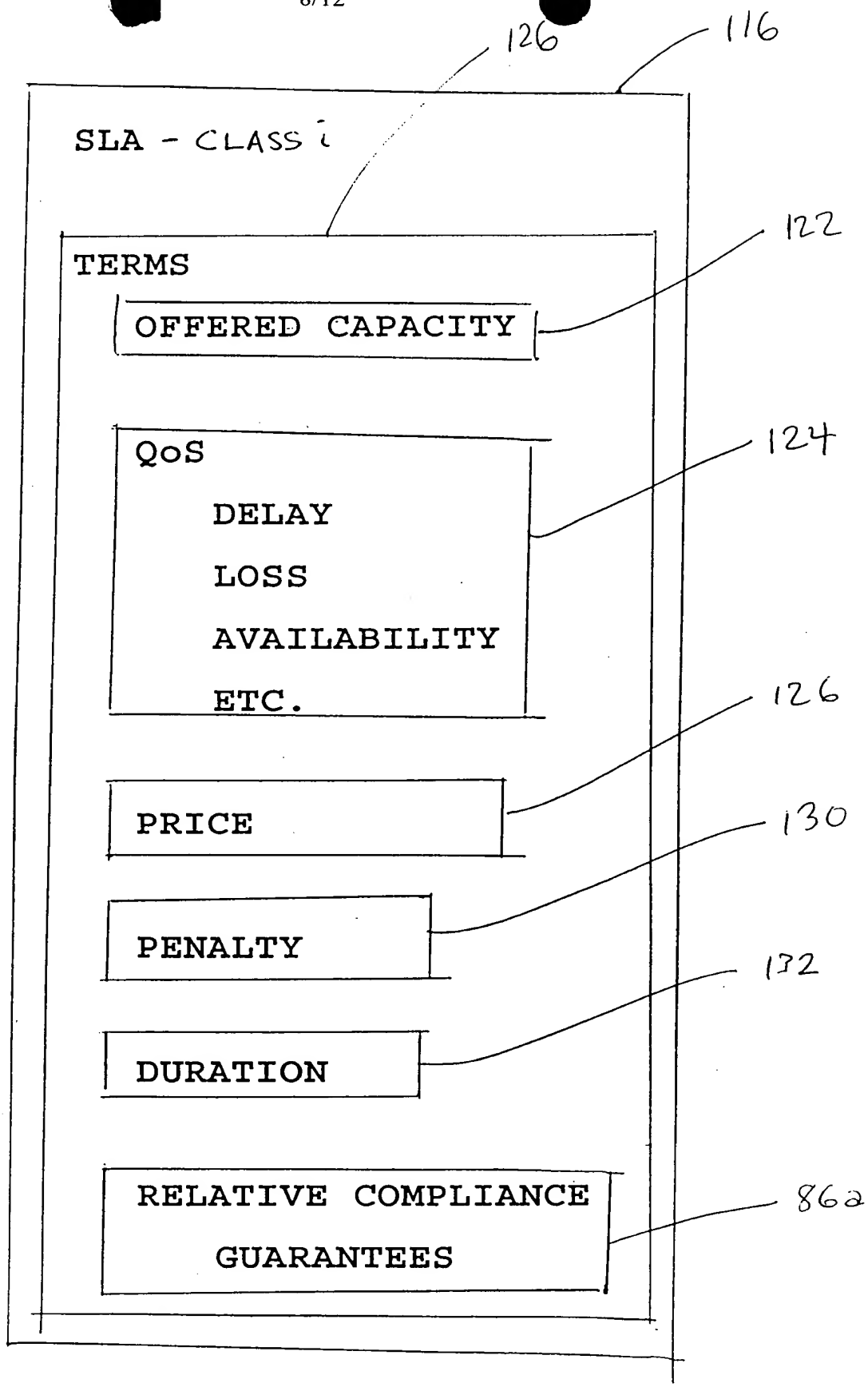
126
116
SLA - CLASS i
TERMS
122
OFFERED CAPACITY
QoS
DELAY
LOSS
AVAILABILITY
ETC.
124
126
PRICE
130
PENALTY
132
DURATION
RELATIVE COMPLIANCE
GUARANTEES
862

FIG. 8

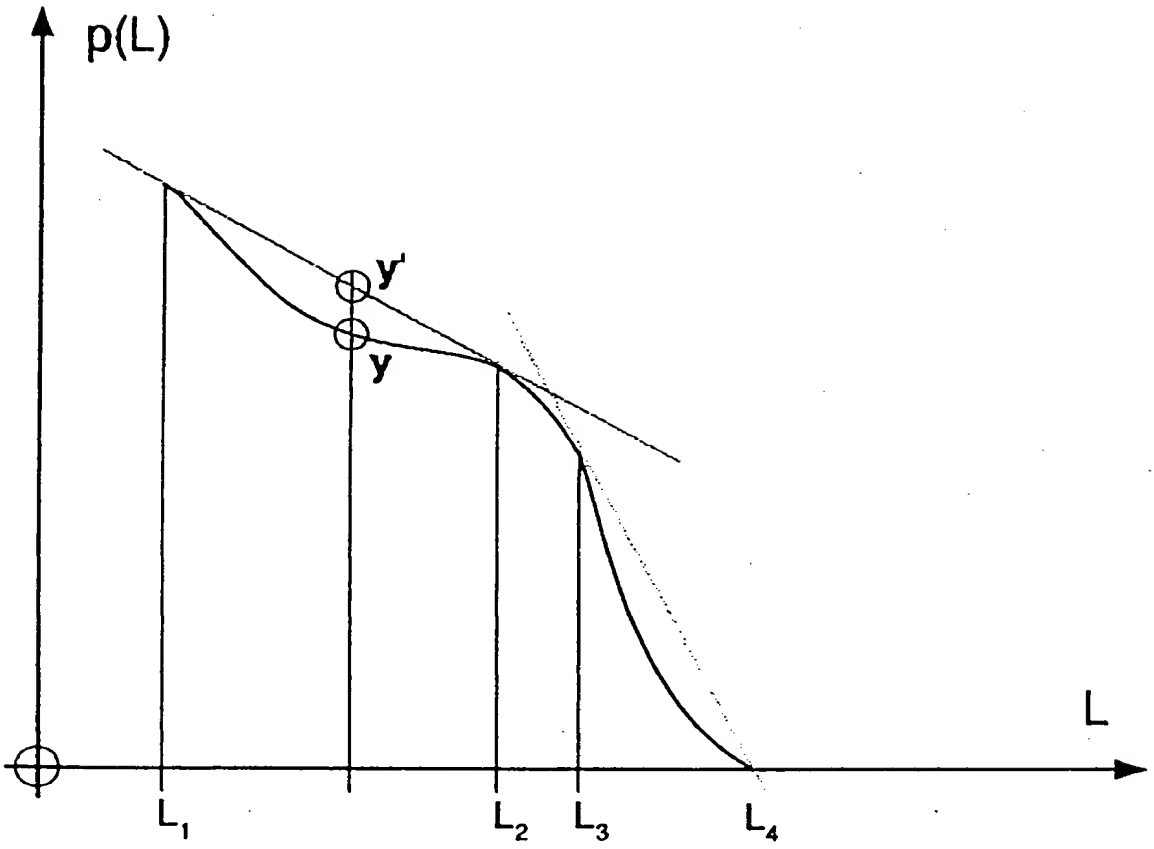

FIG. 9

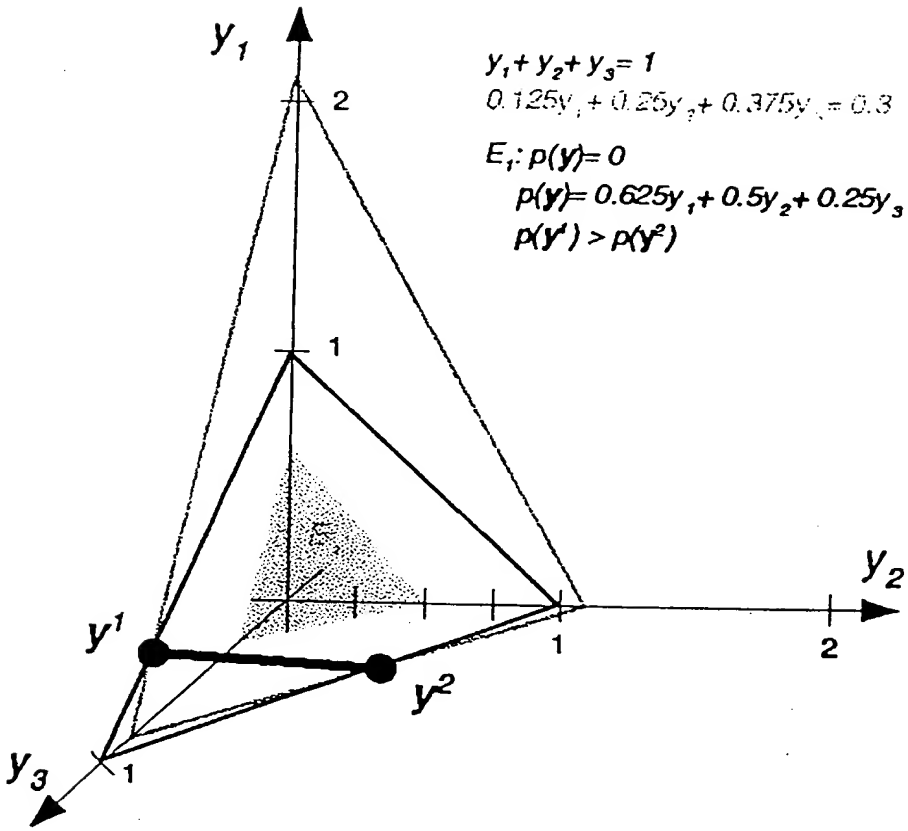
y_1
2
1
y_2
1
2
y_3
1
y^1
y^2
E_1
$y_1 + y_2 + y_3 = 1$
$0.125y_1 + 0.25y_2 + 0.375y_3 = 0.3$
$E_1: p(y) = 0$
$p(y) = 0.625y_1 + 0.5y_2 + 0.25y_3$
$p(y^1) > p(y^2)$

FIG. 10

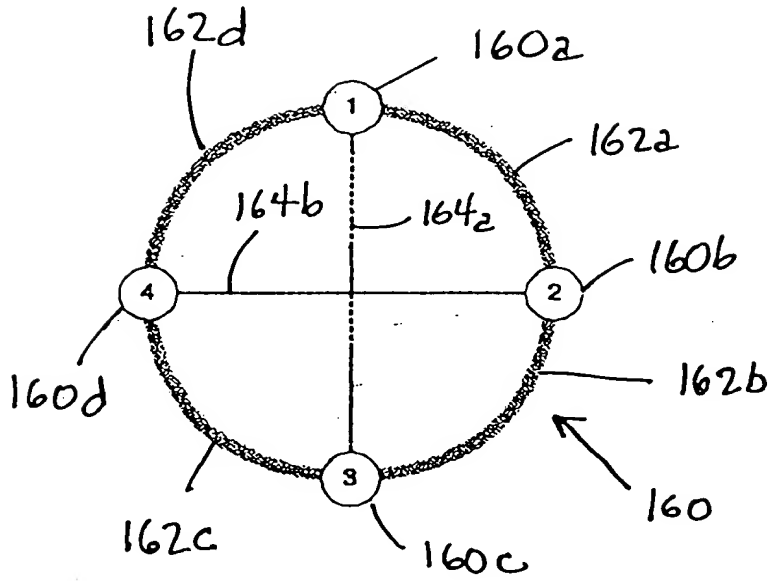
162d
160a
1
162a
164b
164a
160b
4
2
160d
162b
160
3
162c
160c

FIG. 11

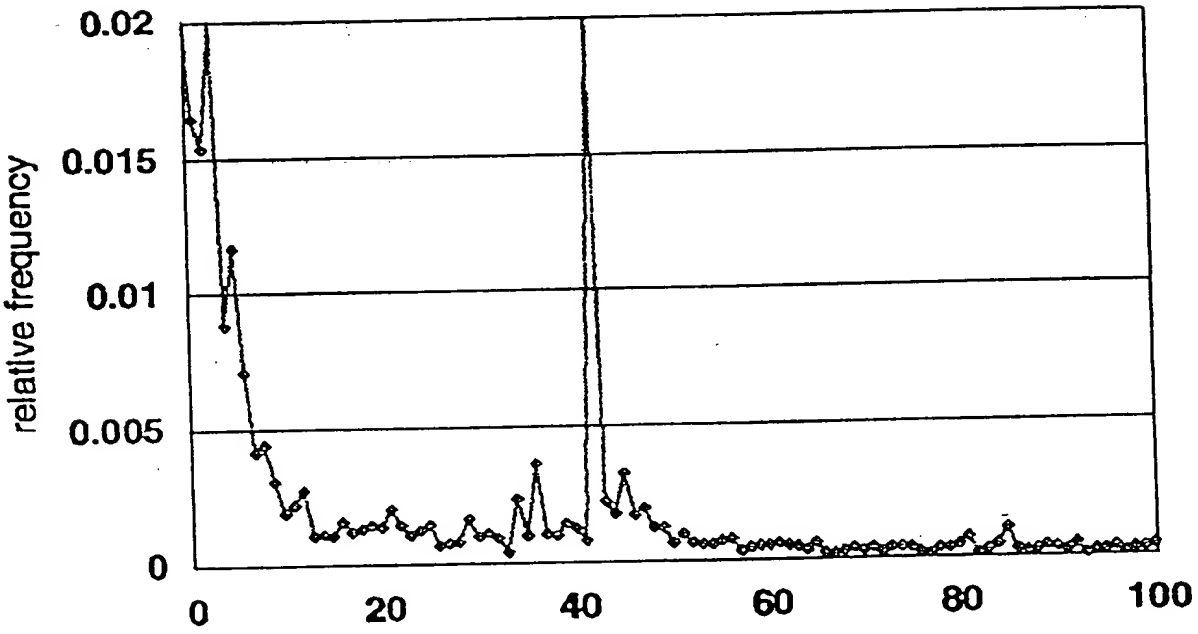
0.02
0.015
0.01
0.005
0
relative frequency
0
20
40
60
80
100

FIG. 12

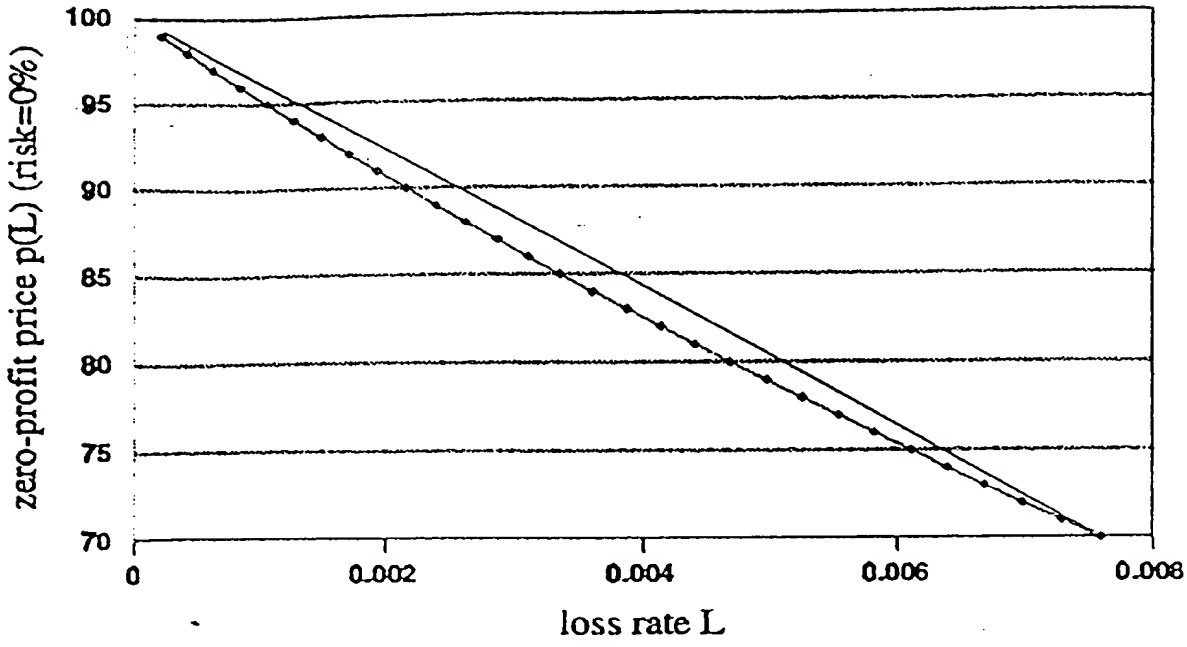
100
95
90
85
80
75
70
zero-profit price p(L) (risk=0%)
0
0.002
0.004
0.006
0.008
loss rate L

FIG. 13

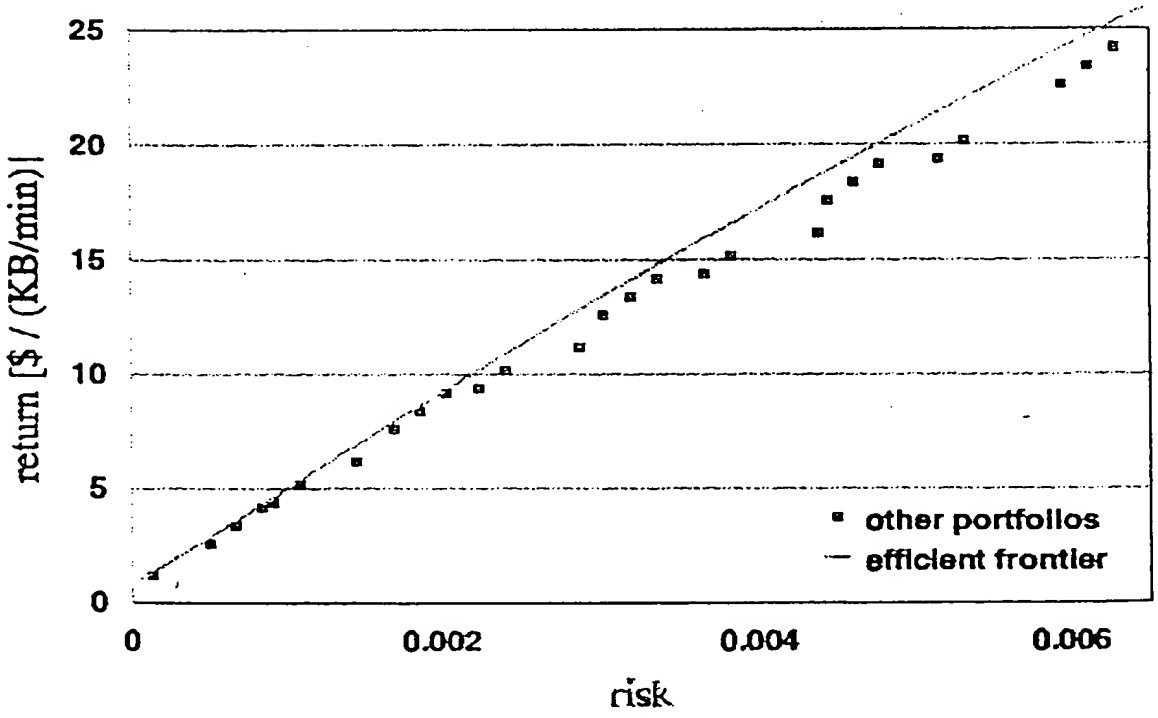
25
20
15
10
5
0
return [$ / (KB/min)]
other portfolios
efficient frontier
0
0.002
0.004
0.006
risk

FIG. 14